Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	56	(ASM adj international) and (diffusion adj barrier) and (metal adj (film or layer))	US-PGPUB; USPAT	OR	ON	2005/11/21 16:59
L2	51	1 and @ad<"20031028"	US-PGPUB; USPAT	OR	ON	2005/11/21 17:01
L3	33	2 and oxygen	US-PGPUB; USPAT	OR	ON	2005/11/21 16:35
L4	8	3 and bridge	US-PGPUB; USPAT	OR	ON	2005/11/21 16:40
L5	1	("6482740").PN.	US-PGPUB; USPAT	OR	OFF	2005/11/21 16:56
L6	0	(ASM adj international) and (diffusion adj barrier) and (metal adj (film or layer))	USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/21 16:41
L7	4	((barrier or metal or metallic) and oxygen and (termination or terminated) and hydroxyl and monolayer).clm.	US-PGPUB; USPAT	OR	ON	2005/11/21 17:01
L8	3	7 and @ad<"20031028"	US-PGPUB; USPAT	OR	ON	2005/11/21 17:06
L9	212	(raaijmakers near3 ivo) or (soininen near3 pekka) or (elers near3 kai near3 erik)	US-PGPUB; USPAT	OR	ON	2005/11/21 17:01
L10	184	9 and @ad<"20031028"	US-PGPUB; USPAT	OR	ON	2005/11/21 17:06
L11	17	10 and (barrier or metal or metallic) and oxygen and hydroxyl and monolayer	US-PGPUB; USPAT	OR	ON	2005/11/21 17:04
L12	3413	438/795,798,627,643,653.ccls.	US-PGPUB; USPAT	OR	ON	2005/11/21 17:06
L13	3041	12 and @ad<"20031028"	US-PGPUB; USPAT	OR	ON	2005/11/21 17:06
L14	2345	257/751,750,753.ccls.	US-PGPUB; USPAT	OR	ON	2005/11/21 17:06
L15	2112	14 and @ad<"20031028"	US-PGPUB; USPAT	OR	ON	2005/11/21 17:07
L16	1891	15 not 13	US-PGPUB; USPAT	OR	ON	2005/11/21 17:07

DOCUMENT-IDENTIFIER: US 20020102405 A1

TITLE: Surfaces that resist the adsorption of biological species

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Claims Text - CLTX (2):

1. An article, comprising: a substrate having covalently bonded thereon a chemical chain, the chain comprising a terminal group comprising the structure: 58wherein the terminal group is hydrophilic; E is selected from the group consisting of nitrogen, **oxygen,** phosphorus and sulfur; X is an organic substituent and m is an integer less than or equal to 3; Y is selected from the group consisting of amides, amide derivatives, amines, amine derivatives, cyclic ethers, sugar derivatives, amino acids, amino acid derivatives, and multiple nitrites and p is an integer greater than 0; X and Y are both free of a hydrogen-bond donor; R.sup.1 is selected from the group consisting of hydrogen, a C.sub.1-C.sub.6 alkyl and an aryl, and n is an integer less than or equal to 2; v represents one or more single bonds, a double bond, or any combination thereof; optionally R.sup.1 can bond to X or Y to form a cyclic structure; and the article being resistant to the adsorption of proteins, cells or bacteria.

Claims Text - CLTX (6):

5. The article of claim 1, wherein a terminal group of the **monolayer** is charged and neutralized by at least one neighboring terminal group of an opposite charge.

Claims Text - CLTX (8):

7. The article of claim 1, wherein the article comprises a **monolayer** of a plurality of chemical chains bonded to the substrate.

Claims Text - CLTX (9):

8. The article of claim 7, wherein the **monolayer** is a self-assembled **monolayer**.

Claims Text - CLTX (10):

9. The article of claim 7, wherein the chemical chain is a first chemical chain and the **monolayer** further comprises a second chemical chain having a different composition from the first chemical chain, the second chemical chain

being present in an amount of less than about 75% of a total of the chemical chains in the **monolayer**.

Claims Text - CLTX (11):
10. The article of claim 9, wherein the second chemical chain is present in an amount of less than about 50% of the total of the chemical chains in the **monolayer**.

Claims Text - CLTX (12):
11. The article of claim 9, wherein the second chemical chain is present in an amount of less than about 25% of the total of the chemical chains in the **monolayer**.

Claims Text - CLTX (13):
12. The article of claim 9, wherein the second chemical chain comprises a terminal group selected from the group consisting of a C.sub.1-C.sub.25 alkyl, an aryl, a carboxylic acid, a thiol, a **hydroxyl** and a quaternary ammonium ion.

Claims Text - CLTX (22):
21. The article of claim 20, wherein Z is selected from the group consisting of **oxygen,** nitrogen, silicon and sulfur.

Claims Text - CLTX (25):
24. The article of claim 23, wherein Z is selected from the group consisting of **oxygen,** nitrogen, silicon and sulfur.

Claims Text - CLTX (28):
27. The article of claim 26, wherein the substrate comprises a material selected from the group consisting of a **metal,** a ceramic and a polymer.

Claims Text - CLTX (32):
31. The article of claim 1, wherein the article is resistant to the adsorption proteins such that the article adsorbs no more than 60% of a **monolayer** of proteins.

Claims Text - CLTX (33):
32. The article of claim 1, wherein the article is resistant to the adsorption proteins such that the article adsorbs no more than 50% of a **monolayer** of proteins.

Claims Text - CLTX (34):
33. The article of claim 1, wherein the article is resistant to the

adsorption proteins such that the article adsorbs no more than 30% of a **monolayer** of proteins.

Claims Text - CLTX (54):
53. An article, comprising: a substrate having covalently bonded thereon a **monolayer** of chemical chains, at least 25% of the chains of the **monolayer being terminated** with a hydrophilic group free of a hydrogen-bond donor, the hydrophilic group being selected from the group consisting of amides, amide derivatives, amines, amine derivatives, cyclic ethers, sugar derivatives, amino acids, amino acid derivatives, and multiple nitrites, and the article being resistant to the adsorption of proteins, cells or bacteria.

Claims Text - CLTX (55):
54. The article of claim 53, wherein the **monolayer** comprises a self-assembled **monolayer**.

Claims Text - CLTX (57):
56. The article of claim 53, wherein each chemical chain of the **monolayer** has an overall neutral charge.

Claims Text - CLTX (58):
57. The article of claim 53, wherein a chemical chain of the **monolayer** is charged and neutralized by at least one neighboring chemical chain of an opposite charge.

Claims Text - CLTX (59):
58. The article of claim 53, wherein the **monolayer** comprises a linker group to bond the hydrophilic group to the substrate.

Claims Text - CLTX (65):
64. The article of claim 53, wherein at least 50% of the chains are **terminated** with the hydrophilic group.

Claims Text - CLTX (66):
65. The article of claim 53, wherein substantially all of the chains are **terminated** with the hydrophilic group.

Claims Text - CLTX (72):
71. The article of claim 69, wherein Z is an **oxygen** atom.

Claims Text - CLTX (82):
81. An article comprising a substrate having a polymer bonded thereon, a

surface of the polymer comprising a first region being resistant to the adsorption of biomolecules, the surface of the polymer further comprising a second region comprising at least one chemical chain **terminated** with a group capable of being derivatized with a ligand for covalent bonding to an analyte, and the article being capable of biospecific binding to a biomolecule.

Claims Text - CLTX (86):
85. The article of claim 84, wherein each of the plurality of chemical chains is **terminated** with oligo(ethylene glycol), group, wherein n is no more than 10, or any of the compositions claimed or listed herein, and mixtures of two or more of any of the above-mentioned compositions.

Claims Text - CLTX (90):
89. An article comprising a substrate having covalently bonded thereon a polyamine, the polyamine being **terminated** with an oligo(ethylene glycol), group, wherein n is no more than 10, or any of the compositions claimed or listed herein, and mixtures of two or more of any of the above-mentioned compositions.

US-PAT-NO: 6306756

DOCUMENT-IDENTIFIER: US 6306756 B1

TITLE: Method for production of semiconductor device

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Brief Summary Text - BSTX (16):

Firstly, as shown schematically in FIG. 25A, generally a metal film is deposited in a thickness amount 1.5 to 2.0 times the depth of trenches 1 for the purpose of increasing the initial amount of accumulation in the trenches 1, for example. During the process of a heat treatment for flow, therefore, the surfaces of the opposed portions of the deposited film (metal film) 3b on the wall defiling a space 2a of the trench 1 contact each other and produce a **bridge** 3a and, as schematically shown in FIG. 25B, give rise to a void 4 within the trench 1, with the result that the void 4 will persist and obstruct the flow. In the diagram, 2 and 5 each stand for an insulating film made of such a substance as SiO.sub.2 or SiN, for example.

Brief Summary Text - BSTX (17):

To be more specific about this point, when the metal intended for the interconnect is deposited by a physical vapor deposition, such as sputtering or vapor deposition, since the directions in which the hurled particles impinge on a substrate constitute a cosine distribution, the accumulation of deposited particles on the space 2a between the adjacent trenches 1 grows in the directions of the trenches 1 with the obliquely impinging particles and induce the occurrence of a overhung portion 3b which will obstruct the accumulation of particles inside the trench 1. When the heat treatment is carried out in the presence of the overhung portion 3b which has grown as described above, the adjacent overhung portions 3b are suffered to contact each other in consequence of thermal expansion and the portions of this contact continuously grow (necking) to induce formation of a **bridge** 3a between the opposed walls of the space 2a. In consequence of the advance of the linkage between the opposed walls of the spaces 2a, the initial empty space remains beneath the region. Since this void 4 cannot be filled by an ordinary heat treatment, the interconnection which is subsequently formed by the CMP is destined to suffer voids to remain therein.

Brief Summary Text - BSTX (18):

Secondly, even when the **bridge** 3a mentioned above is not suffered to occur as schematically shown in FIG. 26A, the problem arises that the accumulation in the trench 1 while undergoing the heat treatment for flow is lifted up onto the space 2a between the adjacent trenches 1 and suffered to leave a void 4 behind within the trench 1 as schematically shown in FIG. 26B, with the result that the produced interconnection will suffer from degraded reliability or even sustain disconnection. To be more specific, in this case, the heat treatment causes the metal once accumulated in the trench 1 to move gradually owing to the surface diffusion which originates in the difference in the radius of curvature of surface as shown schematically in FIG. 26A. Since the accumulated film 3 is still in an energetically metastable state at this stage, however, the movement of the accumulated film 3 is further advanced with the decrease in the surface energy and the interfacial energy as the driving force. The direction in which the accumulated film 3 moves in this case is determined by the relation between the amount of accumulation on the space 2a and the amount of accumulation in the trench 1. On the assumption that the particles involved in the accumulation are simple spheres, the reaction proceeds in reverse proportion to the fourth to the third power of the particle diameter. In other words, the movement of the metal film proceeds in the direction from the side of a small amount of accumulation to the side of a large amount of accumulation as schematically shown in FIG. 26B. Further, when the metal is deposited by an ordinary sputtering technique, the possibility arises in an extreme case even before the heat treatment for flow that accumulated films will be bridged between adjacent spaces 2a and void 4 will be formed in the trench 1.

US-PAT-NO: 6306756

DOCUMENT-IDENTIFIER: US 6306756 B1

TITLE: Method for production of semiconductor device

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Brief Summary Text - BSTX (10):

In recent years, for the fabrication of wiring in the process for production of the semiconductor devices mentioned above, the interconnect method resorting to the damascene process has been attracting attention and has been forming a mainstream in the fabrication under discussion. Specifically, the chemical mechanical polishing (CMP) technique has advanced to a point where electrode lines can be formed as required in an embedded pattern. Thus, the practice of forming the electrode lines with Al and Cu as the material is now prevailing. According to this method, an insulating film (interlayer film) is formed on a semiconducting substrate provided with an active region such as, for example, the active-region-forming surface of a Si substrate prior to the deposition of **metal film** and then trenches are preparatorily formed in the region of the insulating film expected to form the electrode lines.

Brief Summary Text - BSTX (11):

Then, on the surface which has been fabricated to contain the trenches therein, a metal as the material for electrode line is deposited by the ordinary technique of sputtering, collimation sputtering (anisotropic sputtering), or CVD. Thereafter, by a heat treatment, the **metal film** deposited as described above is caused to flow and fill the trenches and **metal film** on the space is removed by CMP to complete the formation of electrode lines as required.

Brief Summary Text - BSTX (12):

In this case, the connections to the active parts or to the electrodes in the lower layers are attained with metallic pieces which are either passed through contact holes formed in the insulating film or embedded in the insulating film during the formation of interconnections. Further, prior to the formation of a **metal film** for electrode lines, a barrier **metal layer** is generally formed.

Brief Summary Text - BSTX (16):

Firstly, as shown schematically in FIG. 25A, generally a **metal film** is deposited in a thickness amount 1.5 to 2.0 times the depth of trenches 1 for the purpose of increasing the initial amount of accumulation in the trenches 1, for example. During the process of a heat treatment for flow, therefore, the surfaces of the opposed portions of the deposited film (**metal film**) 3b on the wall defiling a space 2a·of the trench 1 contact each other and produce a bridge 3a and, as schematically shown in FIG. 25B, give rise to a void 4 within the trench 1, with the result that the void 4 will persist and obstruct the flow. In the diagram, 2 and 5 each stand for an insulating film made of such a substance as SiO.sub.2 or SiN, for example.

Brief Summary Text - BSTX (18):
Secondly, even when the bridge 3a mentioned above is not suffered to occur as schematically shown in FIG. 26A, the problem arises that the accumulation in the trench 1 while undergoing the heat treatment for flow is lifted up onto the space 2a between the adjacent trenches 1 and suffered to leave a void 4 behind within the trench 1 as schematically shown in FIG. 26B, with the result that the produced interconnection will suffer from degraded reliability or even sustain disconnection. To be more specific, in this case, the heat treatment causes the metal once accumulated in the trench 1 to move gradually owing to the surface diffusion which originates in the difference in the radius of curvature of surface as shown schematically in FIG. 26A. Since the accumulated film 3 is still in an energetically metastable state at this stage, however, the movement of the accumulated film 3 is further advanced with the decrease in the surface energy and the interfacial energy as the driving force. The direction in which the accumulated film 3 moves in this case is determined by the relation between the amount of accumulation on the space 2a and the amount of accumulation in the trench 1. On the assumption that the particles involved in the accumulation are simple spheres, the reaction proceeds in reverse proportion to the fourth to the third power of the particle diameter. In other words, the movement of the **metal film** proceeds in the direction from the side of a small amount of accumulation to the side of a large amount of accumulation as schematically shown in FIG. 26B. Further, when the metal is deposited by an ordinary sputtering technique, the possibility arises in an extreme case even before the heat treatment for flow that accumulated films will be bridged between adjacent spaces 2a and void 4 will be formed in the trench 1.

Brief Summary Text - BSTX (20):
When the formation of the **metal film** is carried out in this case by the sputtering technique on the Si substrate which is kept in a heated state, the metal during the initial stage of the film formation undergoes aggregation in the form of islands so as to decrease the surface energy as shown in FIG. 27A.

The aggregation mentioned above is liable to occur conspicuously on the inner wall of the trench 1 particularly because of a low deposition rate. When the aggregation occurs on the lateral wall part in the trench 1, the islands of metal formed in the opening part of the trench 1 are exclusively allowed to grow preferentially as shown in FIG. 27B because these islands of metal in the opening part decrease the angle of anticipation and obstruct the advance of sputtered particles into the trench 1. As a result, the islands of metal which have preferentially grown from the opposed lateral walls of the opening part come into tight contact with each other and the voids 4 are suffered to persist inside the trench 1 and consequently the trench 1 is no longer enabled to be filled with the deposited film 3 as shown in FIG. 27C.

Brief Summary Text - BSTX (22):
Then, in the formation of a buried line by the use of the CMP technique mentioned above, the trenches ought to be accurately formed in conformity with the pattern of the lines. In the photoetching process, therefore, it is necessary that the exposure of the resist to light be prevented from being disturbed by the random reflection of light from the material of the lower layer. In order to preclude the random reflection mentioned above, a TiN layer having low reflectance is formed as an antireflection film prior to the formation of the **metal film** for electrode line. Further, this TiN layer is concurrently used as a **diffusion barrier** for such an interconnection metal as Cu which is liable to diffuse in an insulating material. Incidentally, since the compound TiN is a conductor, the unnecessary part of TiN must be removed after the wiring of Cu, for example, has been formed. This removal cannot be readily attained by etching with an acidic solution because the Cu as the interconnection metal has poor resistance to acids. Thus, the removal of the unnecessary part of TiN ought to be effected concurrently by the CMP technique mentioned above.

Brief Summary Text - BSTX (25):
The method for forming an electrode line by the use of the CMP technique mentioned above has been attracting the attention of many scientists engaging in the manufacture of semiconductor devices. It nevertheless has some problems standing on the way to the reduction to practice. In the formation of an electrode line using Cu as the raw material, for example, there arises the problem that the Cu, in the process of heat treatment for flow, will possibly pass through an underlying insulating film, reach a Si substrate, for example, and cause deterioration of semiconductor characteristics. To avoid this problem, the method of utilizing a barrier metal or an interlayer film for preventing the Cu from being diffused in the Si substrate has been adopted. Since no fully satisfactory barrier in this respect exists at present, this

method is fated to impose a restriction on the temperature of flowing and fail to acquire a fully sufficient flowing temperature. Particularly when a metallic film which has been formed by an ordinary sputtering technique requires flowing, the aforementioned deterioration of the semiconductor characteristics owing to the diffusion of the metal for an electrode line constitutes a serious problem because the **metal film** must be heat-treated in a high degree of vacuum at 750.degree. C. for not less than 10 minutes.

Brief Summary Text - BSTX (47):
The sixth aspect of this invention concerns a method for the production of a semiconductor device having an electrode line formed on a semiconducting substrate, characterized by the steps of forming at least either of a trench and a contact hole in a region destined to form the electrode line on the semiconducting substrate, forming a film selected from the group consisting of a **metal film** containing oxygen and mainly containing at least one selected from the group consisting of Cu, Ag, and Au and an oxidized film of mainly containing at least one selected from the group consisting of Cu, Ag and Au on the surface of the semiconducting substrate having at least either of the trench and the contact hole formed thereon, heating the semiconducting substrate formed (deposited) and, at the same time, causing at least one member selected from the group consisting of Cu, Ag, and Au to flow into the trench and/or the contact hole thereby forming (depositing) a conductive film consisting mainly of at least one member selected from the group consisting of Cu, Ag, and Au, and removing by polishing the part of the conductive film falling outside the regions destined to form the electrode line thereby completing the electrode line.

Brief Summary Text - BSTX (48):
The oxygen-containing **metal film** or the oxidized film mentioned above may be in a form having oxygen already incorporated therein or in a form having a **metal film** already oxidized before the formation of the film.

Brief Summary Text - BSTX (81):
As respects the ambience in which the heat treatment is carried out, the conductive film made of Al tends to have the flowing property thereof impaired when the surface thereof is oxidized. The conductive film as formed, therefore, ought to be heat-treated under pressure as maintained under a vacuum of not more than 1.times.10.sup.-8 Torr. In the case of a **metal film** of Cu, Ag, or Au, since the oxide film formed on the surface is easily reduced, the film as formed may be exposed to the atmosphere. Even when the Cu, Ag, or Au film is oxidized, it is only required to be exposed, during the treatment with pressure and heat, to a reducing ambience or to a vacuum not higher than the

dissociation pressure of the oxide. It is naturally permissible to carry out the heat treatment of the **metal film** while the oxidizing and the reducing gas are supplied simultaneously or alternately to the site of the heat treatment. When the conductive film is made of a Cu--Ag alloy, the flow temperature can be lowered because this is a simple eutectic alloy and has an electrical resistance of 1.9 .mu..OMEGA.cm at most, and an eutectic temperature of 779.degree. C., which is a fairly low melting point.

Detailed Description Text - DETX (59):
Then, the samples having the aforementioned single layer films and laminated films formed therein were heat-treated in the reduced pressure heat-treating device shown in FIG. 3 at 450.degree. C. for 30 minutes, with a reducing gas of N.sub.2 90%--H.sub.2 10% supplied thereto at a flow volume of 1 liter/min, to flow a **metal film** and form an electrode wiring.

Detailed Description Text - DETX (60):
The degrees of flow expressed by the ratio of the thickness, D.sub.min, of a **metal film** embedded by the flow in a trench and the depth, D, of the trench and the results of the test for electrical resistance performed by the four terminal method on samples having an electrode line formed by the CMP are shown additionally in Table 9 and Table 10. It is clearly noted from Table 10 that the degree of flow improved in proportion as the numbers of Cu films and Ag films superposed increased. This trend may be ascribed to an effect of decreasing interface energy and an effect of entropy of the mixture of Cu and Ag.

Detailed Description Text - DETX (225):
Then, the methods for the production of a semiconductor device according to the fourth aspect of this invention remove part of superposed **metal films** to preclude persistence of voids as in trenches prior to the formation of an embedded line by the flow of a conductive metal and, therefore, allow production of a highly reliable semiconductor device possessing lines including no voids and hillocks and satisfactory and uniform characteristics.

Claims Text - CLTX (13):
forming a primary film selected from the group consisting of a **metal film** containing oxygen and mainly containing at least one selected from the group consisting of Cu, Ag, and Au and a metal oxide film mainly containing at least one selected from the group consisting of Cu, Ag and Au on the surface of the semiconducting substrate having at least either of the trench and the contact hole formed thereon, after forming at least either of the trench and the contact hole.

Other Reference Publication - OREF (2):
Davis, "ASM Materials Engineering Dictionary," **ASM International** (1992), pp. 358-359.

Other Reference Publication - OREF (4):
Hu et al., "**Diffusion Barriers** for Studies . . . ", IEEE VMIC Conference (Jun. 9-10, 1986), pp. 181-187.